3.2 Medical Requirements Overview

TABLE 3.2: MEDICAL REQUIREMENTS OVERVIEW

MRID# and Title:	MR084L Acoustic Monitoring and Countermeasures for Long Duration Flights
Sponsor:	Medical Operations
Discipline:	MMOP Environmental Health Working Group (Acoustics Subgroup) Neurological Function (Acoustics Subgroup)
Category:	Medical Requirements (MR)
References:	SSP 50260 ISS MORD
Purpose/Objectives:	• To measure and monitor the acoustic environment of the ISS • To measure acoustic levels produced by hardware • To measure the A-weighted decibel (dBA) levels of crewmembers' exposure over 24 hours. • This monitoring will be used to assist crewmembers in the implementation of effective countermeasure to reduce or eliminate high noise levels.
Measurement Parameters:	• A-weighted overall Sound Pressure Level in dBA measuring crewmember noise exposure (crew-worn & static audio dosimeter) • ⅓ Octave (frequency) Band Sound Pressure Levels in dB at discrete locations (Sound Level Meter)
Deliverables:	Preliminary and final acoustic measurement reports prepared on-ground by the Acoustics Office/SF22
Flight Duration:	≥ 30 days
Number of Flights:	All ISS Increments
Number and Type of Crew Members Required:	• All crewmembers are trained in crew-worn Audio Dosimeter measurements & hearing protection devices • At least two crewmembers trained in Sound Level Meter (SLM) measurements; only one (1) required as in-flight operator
Other Flight Characteristics:	N/A

3.3 Preflight Training

TABLE 3.3: PREFLIGHT TRAINING

<table>
<tr><td>Preflight Training Activity
Description:</td><td colspan="4">Training will include nominal operation of the Audio Dosimeter and Sound Level Meter (SLM) hardware, malfunction procedures and data transfer, as well as familiarization of generic hearing protection devices [e.g. ANR (Acoustic Noise Reduction) headsets, foam earplugs]</td></tr>
<tr><td rowspan="2">Schedule:</td><td colspan="2">Duration:</td><td>Schedule:</td><td>Personnel Required:</td></tr>
<tr><td colspan="2">EHS Acoustic Training – Inexperienced CM 60 min. (includes Audio Dosimeter, Sound Level Meter, & EarQ software – see MRID MR086L)

EHS Acoustic Training – Experienced CM 30 min</td><td>No earlier than L-18 months</td><td>Crewmembers/Instructors</td></tr>
<tr><td rowspan="2">Ground Support Requirements Hardware/Software</td><td colspan="2">Preflight Hardware:</td><td>Preflight Software:</td><td>Test Location:</td></tr>
<tr><td colspan="2">Audio Dosimeter
Sound Level Meter
Medical Equipment Computer
RS 232 Cable
Hearing Protection Devices
Rechargeable Battery (for ANR headsets)</td><td>Certified “Noise Explorer” on MEC</td><td>U.S.</td></tr>
<tr><td rowspan="4">Training Facilities</td><td>Minimum Room Dimensions:</td><td>Number of Electrical Outlets:</td><td>Temperature Requirements:</td><td>Special Lighting:</td></tr>
<tr><td>8' x 10'</td><td>Two</td><td>Ambient</td><td>N/A</td></tr>
<tr><td>Hot or Cold Running Water:</td><td>Privacy Requirements:</td><td colspan="2">Other:</td></tr>
<tr><td>N/A</td><td>N/A</td><td colspan="2">• 1 table, 6-8 chairs
• Training may take place in Bldg 44 acoustic chambers playing recordings of ISS environment.</td></tr>
<tr><td>Constraints/Special Requirements:</td><td colspan="4">None</td></tr>
<tr><td>Launch Delay Requirements:</td><td colspan="4">Crewmembers may request refresher training if necessary.</td></tr>
<tr><td>Notes:</td><td colspan="4">Experienced crewmembers (CM) – those CMs who have had EHS Acoustic Training within the past 1½-year.
Inexperienced CMs – those CMs who have never had EHS Acoustic Training or have had training more than 1½ year ago.</td></tr>
</table>

3.4 Preflight Activities

TABLE 3.4: PREFLIGHT ACTIVITIES

<table>
<tr><td rowspan="2">Preflight Activity Description:</td><td colspan="4">Crewmembers will become familiar with ISS hearing protection devices, be fit for custom hearing- protection devices, and be fit-checked to ensure proper fit of the custom earplugs.</td></tr>
<tr><td>Schedule:</td><td colspan="2">Duration:</td><td>Schedule:</td><td>Personnel Required:</td></tr>
<tr><td>Schedule:</td><td colspan="2"><u>Preflight activities will take two separate sessions</u>:

Session 1 – 30 minutes
Familiarize crew with countermeasures
Take ear impressions for custom earplugs

Session 2 – 30 minutes
Fit-check of custom earplugs</td><td>L-6 months</td><td>All Crewmembers/Audiologist/Instructor

All Crewmembers/Audiologist/Hardware Engineer</td></tr>
<tr><td rowspan="2">Ground Support Requirements Hardware/Software</td><td colspan="2">Preflight Hardware:</td><td colspan="2">Preflight Software:</td><td>Test Location:</td></tr>
<tr><td colspan="2">ISS hearing protection devices</td><td colspan="2">N/A</td><td>US</td></tr>
<tr><td rowspan="4">Testing Facilities</td><td>Minimum Room Dimensions:</td><td>Number of Electrical Outlets:</td><td>Temperature Requirements:</td><td colspan="2">Special Lighting:</td></tr>
<tr><td>8' x 10'</td><td>None</td><td>Ambient</td><td colspan="2">None</td></tr>
<tr><td>Hot or Cold Running Water:</td><td>Privacy Requirements:</td><td>Vibration/Acoustic Isolation:</td><td colspan="2">Other:</td></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td><td colspan="2">Table, 4-6 chairs</td></tr>
<tr><td>Constraints/Special Requirements:</td><td colspan="5">• Additional time may be necessary for Session 2 if earplugs do not fit.
.</td></tr>
<tr><td>Notes:</td><td colspan="5">N/A</td></tr>
<tr><td rowspan="2">Data Delivery</td><td colspan="5">Data/Report to Designated Recipients (Nominal/Contingency):</td></tr>
<tr><td colspan="5">None</td></tr>
</table>

3.5 In-Flight Activities

TABLE 3.5.1a: IN-FLIGHT ACTIVITIES – Audio Dosimeter 24-hour Measurements

In-Flight Activity	Audio Dosimeter 24-hour measurements:		
Description:	**Crew-worn measurements**: Crewmembers will don the audio dosimeter for approx 15 hours, record data, reset dosimeter and continue to wear the dosimeter during the 8½-hr sleep period. The audio dosimeter will measure the 24 hr. dBA level exposure of the crewmember. **Static Location Measurements**: The static location measurement involves the placement of the audio dosimeter in a specified location for 14-16 hours, 12 hours minimum, and record data. The Acoustics Office/SF22 will determine locations.		
	Duration:	**Schedule:**	**Personnel Required:**
Schedule:	Crew-worn audio dosimeter measurements for all crewmembers: Unstow – 10 min (Performed during evening preparation the night prior to scheduled measurements) Set-up (Day 1) – 10 min Crew worn unattended approx.15 hrs Record Data/Reset dosimeter 10 min Crew worn unattended during sleep 8½ hrs Record data/Stow (Day 2) 20 min	• 2nd & 4th month of Increment (and 6th month, if applicable) – includes time required for unstow, stow, set-up and attachment • At the discretion of Acoustic Lead or designee in conjunction with IPs	All Crewmembers
	Static location audio dosimeter measurements for all 3 dosimeters: Unstow/Set-up 20 min Location measurement approx.14-16 hrs (12 hours minimum) Record data/Stow 20 min	• 2nd & 4th month of Increment (and 6th month, if applicable) • At the discretion of Acoustic Lead or designee in conjunction with IPs • Following crew-worn dosimeter activity, if possible, to save stow/unstow time • Locations determined by Acoustics Office/SF22	1 Crewmember for unstow/set-up/record data/stow

In-Flight Activities (cont'd.)

Procedures:	Procedures are contained within the ISS System Operations Data File (SODF) Medical Operations Book: • Audio Dosimeter Operations
Constraints / Special Requirements:	Batteries are changed before the 24-hour measurement. Crew Worn Measurements: • Crew should don the dosimeters and start the measurement before post-sleep activities. • Record daytime data (day 1) after presleep, just before sleep. • Record nighttime data (day 2) immediately after waking, before postsleep activity. • To be done during a nominal workday. • Can stow after breakfast (day 2) or schedule crew worn and static measurement activities consecutively to save 20 minutes of unstow/stow time.
Photo / TV Requirements:	N/A
Mission Extension Requirements:	N/A
Landing Wave-Off Requirements:	N/A
Cold Stowage:	N/A
Notes:	10 min unstow to be performed during evening preparation the night prior to scheduled measurements
Data Delivery:	**Data/Report to Designated Recipients (Nominal/Contingency):**
	For Expedition 1 and subs, measurement values will be transferred from the logbook to an Excel template on the MEC, which will be downlinked with CHeCS data transfer. Report will be delivered to the Crew Surgeon by the Acoustics Office/SF22 within 8 hours of receipt of data.
Resupply:	The half-Cargo Transfer Bag (CTB), Acoustic Countermeasure Kit will be resupplied every crew rotation

TABLE 3.5.1b: IN-FLIGHT ACTIVITIES – Engineering Acoustic Evaluation - SLM

<table>
<tr><td>In-Flight Activity
Description:</td><td colspan="3">The Sound Level Meter (SLM) will be used to obtain point measurements aboard the ISS. Recorded acoustic levels measured with the SLM will be saved and transferred to the MEC via the RS 232 cable and then downlinked with CHeCS data transfer. In a contingency, measurements will be called down.</td></tr>
<tr><td rowspan="5">Schedule:</td><td>Duration</td><td>Schedule</td><td>Personnel Required</td></tr>
<tr><td>Sound Level Meter Checkout 15 min</td><td>First usage of SLM after delivery or resupply</td><td>1 Crewmember</td></tr>
<tr><td><u>Engineering Acoustic Evaluation - SLM</u>:
Unstow/Set-up 20 min
SLM point measurements 2 min/location
Record Data/Stow 20 min</td><td>Once/increment</td><td>1 Crewmember</td></tr>
<tr><td><u>SLM Survey of ISS:</u> A series of measurements within the ISS recording the spectral level at each location.
Unstow/Set-up 20 min
Survey 50 min (2 min/location)
Record Data/Stow 20 min</td><td>Once every 2 months</td><td>1 Crewmember</td></tr>
<tr><td>SLM Data Transfer to MEC 15 min</td><td>Follows each session (spot-check or survey)</td><td>1 Crewmember</td></tr>
<tr><td>Procedures:</td><td colspan="3">Procedures are contained within the ISS System Operations Data File (SODF) Medical Operations Book:
Sound Level Meter Checkout
Sound Level Meter Operation
Sound Level Meter Data Transfer</td></tr>
<tr><td>Constraints / Special Requirements:</td><td colspan="3">Crewmembers should not talk while taking measurements, and all music should be turned off.
In the event that noise levels exceed specified limits, the crew will call down the dB readings. The ground support team will then refer to the Flight Rule B13-152.
Locations of measurement and survey will be designated in flight note.
Not to be scheduled during exercise or ground communication session.
Not to be scheduled on the same week as SLM Survey and Engineering Acoustic Evaluation-Shumomer.</td></tr>
<tr><td>Photo/TV Requirements:</td><td colspan="3">N/A</td></tr>
<tr><td>Cold Stowage Requirements:</td><td colspan="3">N/A</td></tr>
<tr><td>Mission Extension Requirements:</td><td colspan="3">N/A</td></tr>
<tr><td rowspan="2">Data Delivery</td><td colspan="3">Data/Report to Designated Recipients (Nominal/Contingency):</td></tr>
<tr><td colspan="3">A preliminary report will be delivered to the Crew Surgeon within 1 week after data are received on the ground. A final report will be submitted within 2 weeks after the end of mission.</td></tr>
<tr><td>Resupply</td><td colspan="3">The half-CTB, Acoustic Countermeasure Kit will be resupplied with every crew rotation.</td></tr>
</table>

TABLE 3.5.1c: IN-FLIGHT ACTIVITIES – Acoustic Countermeasures (Contingency)

<table>
<tr><td>In-Flight Activity
Description:</td><td colspan="3">If the 24-hour average noise level as measured by the audio dosimeter in any habitable module is greater than the acceptable decibel limit, countermeasure action(s) will be taken. Hearing protection devices can be found in the Acoustic Countermeasure Kit.</td></tr>
<tr><td rowspan="2">Schedule:</td><td>Duration</td><td>Schedule</td><td>Personnel Required</td></tr>
<tr><td>Crewmember hearing protection device - As needed</td><td>Power off the greatest noise producer(s)

Reschedule the timeline so that especially noisy experiments do not occur on the same day.

Wear hearing protection during the day and/or during sleep to allow recovery from the noise.</td><td>Crewmembers</td></tr>
<tr><td>Procedures:</td><td colspan="3">None</td></tr>
<tr><td>Constraints / Special Requirements:</td><td colspan="3">• After the assessment of noise levels on ISS, the Acoustics Office/SF22 may give a preliminary report to the crew surgeon regarding crewmember use of hearing protection devices.
• Crewmembers have the discretion of which hearing protection device (and, in the case of custom earplugs, which filter) will be worn. The crew surgeon and audiologist may, based on noise level reports, make recommendations to crewmembers for hearing protective devices (and filters) found onboard that accommodate Flight Rule B13-152, as well as typical communication needs.
• The noise level limit may be found in Flight Rule B13-152</td></tr>
<tr><td>Photo/TV Requirements:</td><td colspan="3">N/A</td></tr>
<tr><td>Cold Stowage Requirements:</td><td colspan="3">N/A</td></tr>
<tr><td>Mission Extension Requirements:</td><td colspan="3">N/A</td></tr>
<tr><td rowspan="2">Data Delivery</td><td colspan="3">Data/Report to Designated Recipients (Nominal/Contingency):</td></tr>
<tr><td colspan="3">N/A</td></tr>
<tr><td>Notes:</td><td colspan="3">• Wearing hearing protection may impact the communication among the crew, with the ground, and the ability to hear alert tones.
• Wearing hearing protection for prolonged periods of time may cause pain, irritation and possibly infection. The crew surgeon and audiologist may, should a crewmember complain about a hearing protective device, make recommendations for modifying hearing protection devices found onboard and their use.</td></tr>
</table>

TABLE 3.5.2: IN-FLIGHT HARDWARE

Hardware/Software Name	P/N
Half-CTB, Acoustic Countermeasure Kit	SEG46117646-301
Full-CTB, Acoustic Countermeasure Kit (flown when needed)	SEG46117646-302
Medical Equipment Computer	SEG46116031-XXX
Audio Dosimeter Excel Template & "Noise Explorer" Software	N/A

3.6 Postflight Activities – No Postflight Activities

3.7 Summary Schedule

TABLE 3.7: SUMMARY SCHEDULE

ACTIVITY	DURATION	SCHEDULE	PERSONNEL REQUIRED	CONSTRAINTS/ SPECIAL REQUIREMENTS
Preflight Training				
EHS Acoustic Training – Inexperienced CMs	60 min	No earlier than L-18 months	Crewmembers/Instructors	None
EHS Acoustic Training – Experienced CMs	30 min			
Preflight Activities				
Preflight activities will take two separate sessions:		L-6 months		
Session 1 Familiarize crew with countermeasures & take ear impressions for custom earplugs	30 min		Crewmembers/Audiologist/ Instructor	
Session 2 Fit-check of custom earplugs	30 min		Crewmember/Audiologist/ Hardware Engineer	Additional time may be necessary for Session 2 if custom earplugs do not fit.

TABLE 3.7: SUMMARY SCHEDULE (cont'd)

ACTIVITY	DURATION	SCHEDULE	PERSONNEL REQUIRED	CONSTRAINTS/ SPECIAL REQUIREMENTS
In-Flight Activities				
Crew-worn audio dosimeter measurements for all 3 dosimeters: Unstow – (Performed during evening preparation the night prior to scheduled measurements) Set-up (Day 1) Crew worn unattended Record Data/Reset dosimeter Crew worn unattended during sleep Record data/Stow (Day 2)	 10 min 10 min approx. 15 hrs 10 min 8½ hrs 20 min	2nd & 4th month of Increment (and 6th month, if applicable) includes time required for unstow, stow, set-up and attachment At the discretion of Acoustic Lead or designee in conjunction with IPs.	All crewmembers	Crew should don the audio dosimeters, and start the measurement before post-sleep activities. Record daytime data (day 1) after presleep, just before sleep. Record nighttime data (day 2) immediately after waking, before postsleep activity. To be done during a nominal workday. Can stow after breakfast (day 2) or schedule crew worn and static measurement activities consecutively to save 20 minutes of unstow/stow time. After the assessment of noise levels on ISS, the Acoustics Office/SF22 may give a preliminary report to the crew surgeon regarding crewmember use of hearing protection devices. Crewmembers have the discretion of which hearing protection device (and, in the case of custom earplugs, which filter) will be worn. The crew surgeon and audiologist may, based on noise level reports, make recommendations to crewmembers for hearing protective devices (and filters) found onboard that accommodate Flight Rule B13-152, as well as typical communication needs.

TABLE 3.7: SUMMARY SCHEDULE (cont'd)

ACTIVITY	DURATION	SCHEDULE	PERSONNEL REQUIRED	CONSTRAINTS/ SPECIAL REQUIREMENTS
Static location audio dosimeter measurements for all 3 dosimeters: Unstow/Set-up Location measurement Record data/Stow	 20 min approx. 14-16 hrs (12 hours minimum) 20 min	2nd & 4th month of Increment (and 6th month, if applicable)	1 crewmember for unstow/ set-up/stow	Locations will be determined by Acoustics Office/SF22. Following crew-worn audio dosimeter activity if possible to save stow/unstow time Schedule and recommendation on duration and location of deploy to be submitted to the BME Increment Manager by Acoustics Office/SF22.
Sound Level Meter Checkout	15 min	First usage of SLM after delivery or resupply	1 crewmember	N/A

TABLE 3.7: SUMMARY SCHEDULE (cont'd.)

ACTIVITY	DURATION OF ACTIVITY	SCHEDULE	PERSONNEL REQUIRED	CONSTRAINTS/ SPECIAL REQUIREMENTS
Engineering Acoustic Evaluation - SLM	Unstow/Set-up 20 min Measurement 2 min Record Data/Stow 20 min	Once/increment	1 crewmember	-Crewmembers should not talk while taking measurements, and all music should be turned off. -In the event that noise levels exceed specified limits, the crew will call down the dB readings. -The ground support team will then refer to the Flight Rule B13-152. -Locations of measurement and survey will be designated in flight note. -Not to be scheduled during exercise or ground communication session. -Not to be scheduled on the same week as SLM Survey and Engineering Acoustic Evaluation-Shumomer.
Sound Level Meter Survey of ISS	Unstow/Set-up 20 min Survey 50 min (2 min/location) Record Data/Stow 20 min	Once every 2 months	1 crewmember	-A series of measurements within the ISS recording the spectral level at each location. Not to be scheduled during exercise or ground communication session. -Not to be scheduled on the same week as SLM Survey and Engineering Acoustic Evaluation-Shumomer

TABLE 3.7: SUMMARY SCHEDULE (cont'd.)

ACTIVITY	DURATION OF ACTIVITY	SCHEDULE	PERSONNEL REQUIRED	CONSTRAINTS/ SPECIAL REQUIREMENTS
Sound Level Meter Data Transfer	15 min	Follows each session (spot-check or survey)	1 crewmember	None
Acoustic Countermeasures (Contingency)	As needed	As needed	Crewmembers	Crewmembers have the discretion of which hearing protection device (and, in the case of custom-molded earplugs, which filter) will be worn. Wearing hearing protection may impact communication among the crew, with the ground, and the ability to hear alert tones. Wearing hearing protection for prolonged periods of time may cause pain, irritation and possibly infection. Noise level limit may be found in Flight Rule B13-152
Wheels-Stop: N/A				
Postflight: N/A				
Postflight Debrief				
Debrief	No extra time	~R+30 days	Crewmembers/Acoustic Office/SF22	Included as part of the Med Ops overall debrief